

Finding the Sweet Spot

Bridging X3D, S1000D, and SCORM
for Embedded Performance Assessment and Life
Cycle Training Content Management

The 10th Annual MOVES Research and Education Summit
July 14, 2010



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Sweet Spot Project Objectives

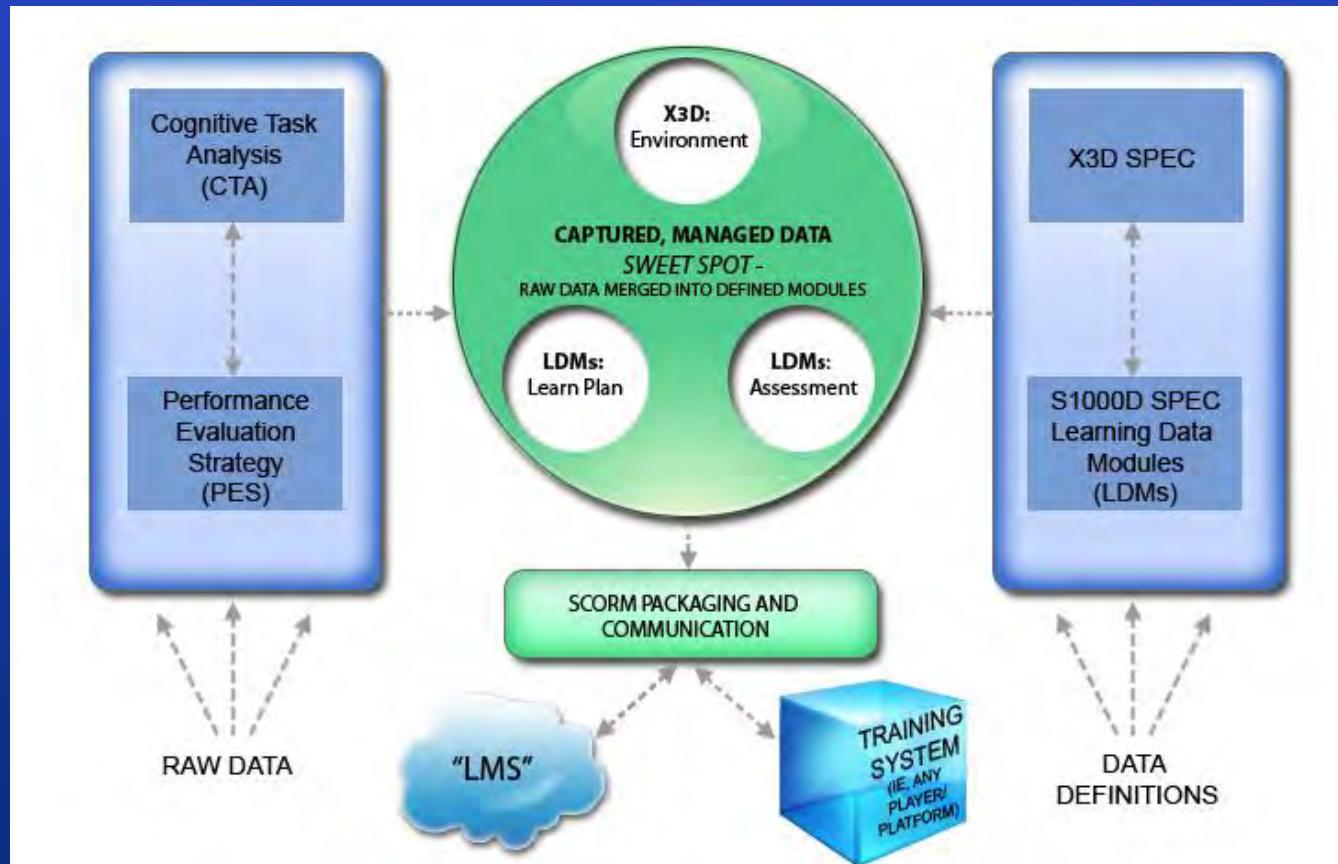
Enable accurate, embedded assessments in virtual environments by

- Integrating X3D, S1000D, SCORM standards
- Capturing performance data using SCORM
- Life-cycle managing assessment content and 3D graphics using S1000D in a Common Source Database

Foundational Standards

	X3D	S1000D	SCORM
What it is:	XML-based ISO standard for representing 3D computer graphics	XML-based technical data spec	XML-based collection of standards and specs to package and track e-Learning in an LMS

Conceptual “Sweet Spot”



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 **ADVANCED DISTRIBUTED LEARNING**

Significance

- Assessment
 - Enable constructed-response assessment as needed for higher order thinking skills
 - Extend SCORM capabilities beyond verbal learning
- Life Cycle Management
 - Align assessment content with fielded systems and technical data

Demonstration



Task assessment start

Favorites S1000D Bike Sample - Sweet Spot

S1000D Bike Sample - Sweet Spot

HIDE MENU

S1000D Bike Sample - Sweet Spot

Learning Plan

Module 1 - Introduction to the bike

Module 2 - Bike Overview

Module 3 - Steering System

Steering System Description

Remove and Install Procedures

Assessment

Module 4 - Drive Train

Drive Train Description

Drive Train Maintenance

Assessment

Module 5 - Wheels

Wheels Description

Wheel Maintenance

Assessment

Module 6 - Brake System

Brake System Description

Brake System Maintenance Procedures

Assessment

Module 7 - General Components

Bicycle Maintenance

Pre and Post Operation Procedures

Assessment

Done

VIEW DEBUG

CLOSE ITEM

EXIT WITHOUT SAVING DEBUG

RETURN TO LMS

Learner Task 5.1: Inspect tire for foreign objects, remove if found

Instructions

1. View tire by selecting viewpoints
2. Fully rotate and closely inspect the tire for damage
3. Then remove any foreign objects by selecting them

I'm Ready to Start

When ready:

Perform this Task Again

Continue with Assessment

X3D Scene



Task feedback

Assessment events are first reported from X3D to HTML via DOM, then to the Learning Management System (LMS).

HTML-X3D script trace

```
Initialize Successful![2] Task5_1.js.setupListeners() start;  
[3] Task5_1.js.setupListeners() complete;
```



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Task assessment success

File Edit View Favorites Tools Help

★ Favorites S1000D Bike Sample - Sweet Spot

S1000D Bike Sample - Sweet Spot

HIDE MENU

Learning Plan

Module 1 - Introduction to the bike

Module 2 - Bike Overview

Module 3 - Steering System

Steering System Description

Remove and Install Procedures

Assessment

Module 4 - Drive Train

Drive Train Description

Drive Train Maintenance

Assessment

Module 5 - Wheels

Wheels Description

Wheel Maintenance

Assessment

Module 6 - Brake System

Brake System Description

Brake System Maintenance Procedures

Assessment

Module 7 - Service Overview

Bicycle Maintenance

Pre and Post Operation Procedures

Assessment

Task 5.1

VIEW DEBUG CLOSE ITEM EXIT WITHOUT SAVING DEBUG RETURN TO LMS

Learner Task 5.1: Inspect tire for foreign objects, remove if found

Instructions	X3D Scene	Task feedback
<ol style="list-style-type: none">View tire by selecting viewpointsFully rotate and closely inspect the tire for damageThen remove any foreign objects by selecting them <p>I'm Ready to Start</p>		<p>Full Wheel Rotation Complete</p> <p>Nail Removed After Rotation</p> <p>Elapsed time 22.9 seconds</p> <p>Assessment events are first reported from X3D to HTML via DOM, then to the Learning Management System (LMS).</p>
When ready:	<p>Perform this Task Again</p> <p>Continue with Assessment</p>	<p>HTML-X3D script trace</p> <pre>Initialize Successful![2] Task5_1.js.setupListeners() start; [3] Task5_1.js.setupListeners() complete; [4] Task5_1.js.notifyX3dSceneUserStarted() set UserInteractionScript.userStartSignal = true; [5] rotationComplete() fullWheelRotationComplete event received from X3D scene; [6] elapsedTimeComplete() elapsedTime event received from X3D scene; [7] touchComplete() nailTouchedAfterRotationReport event received from X3D scene;</pre>

Done

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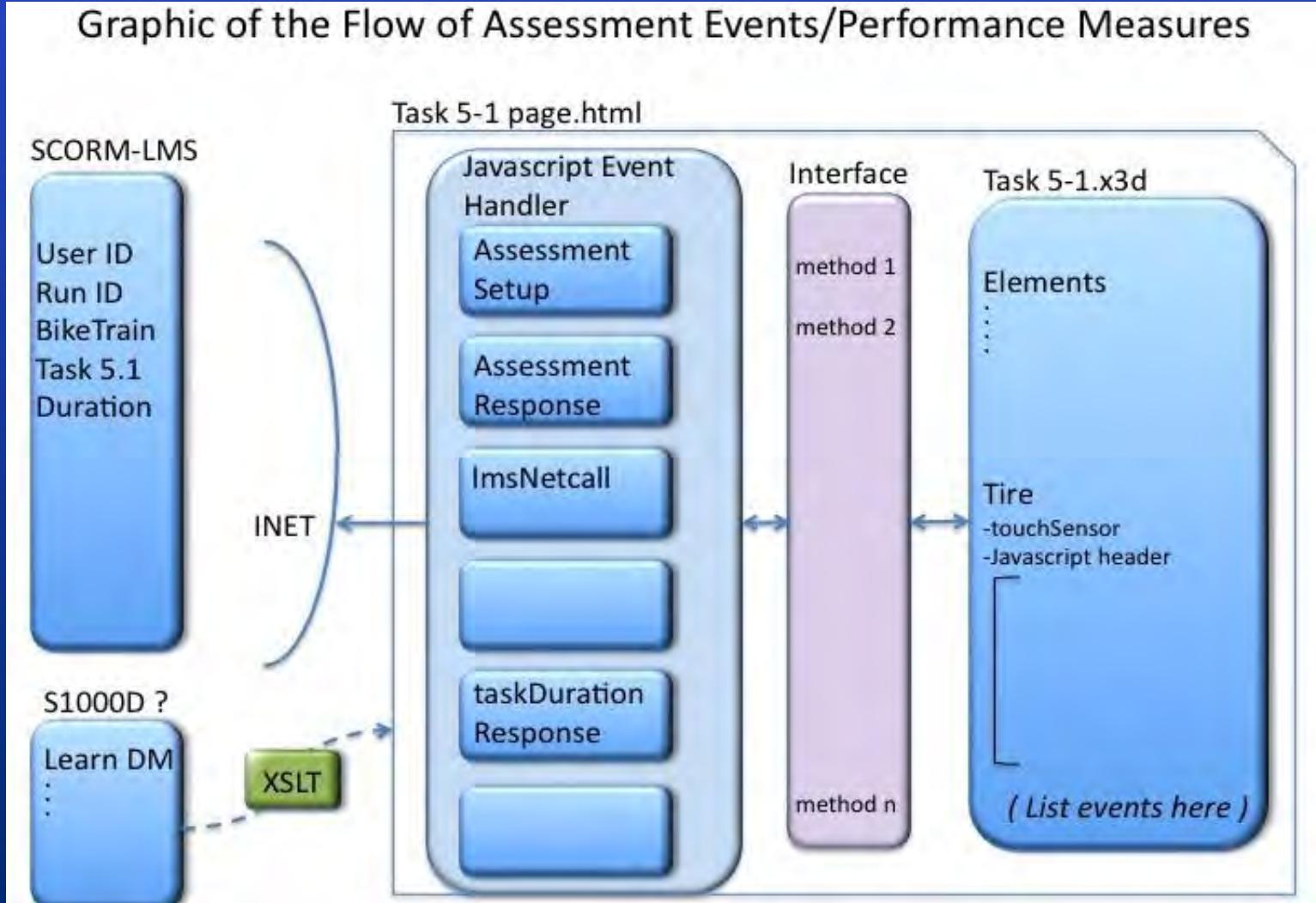
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Task assessment failure

X3D-S1000D-SCORM Communications

Graphic of the Flow of Assessment Events/Performance Measures



Accomplishments to Date

Period of Performance: March – November 2010

- Cognitive Task Analysis for repairing bike tire
- Storyboard system and assessment
- X3D passing progress data to SCORM and LMS
- Commit assessment content to S1000D learning DM
- Build out full sample system and assessment
- Build XSLT to convert S1000D to html
- Write analysis paper

Sweet Spot Project Team

Member	Organization	Role
Wayne Gafford (wayne.gafford@adlnet.gov)	ADL	Project Coordinator S1 Analyst
Don Brutzman (brutzman@nps.mil)	NPS/MOVES	X3D Development Lead
Miriam Heller	ADL/IDA	Project Lead Writer/Researcher
Leslie Lucas	SLC	Cognitive Task Analyst
Eric Roberts	ADL/IDA	Assessment Designer
Schawn Thropp/Tyler Shumaker	ADL/CTC	SCORM Analyst
Jeff Weekley/Jeff Malnick	NPS/MOVES	X3D Development Team
Peter Smith	JADL	Immersive Tech. Analyst

Backup Slides



X3D - Extensible 3D Graphics Int'l Standard

- Web capable, scene graph and text (XML)-based encoding
- Expresses geometry, behaviors, user interaction
- Affords life-cycle management via archival publications and content reuse



S1000D – Industry Technical Manual Spec

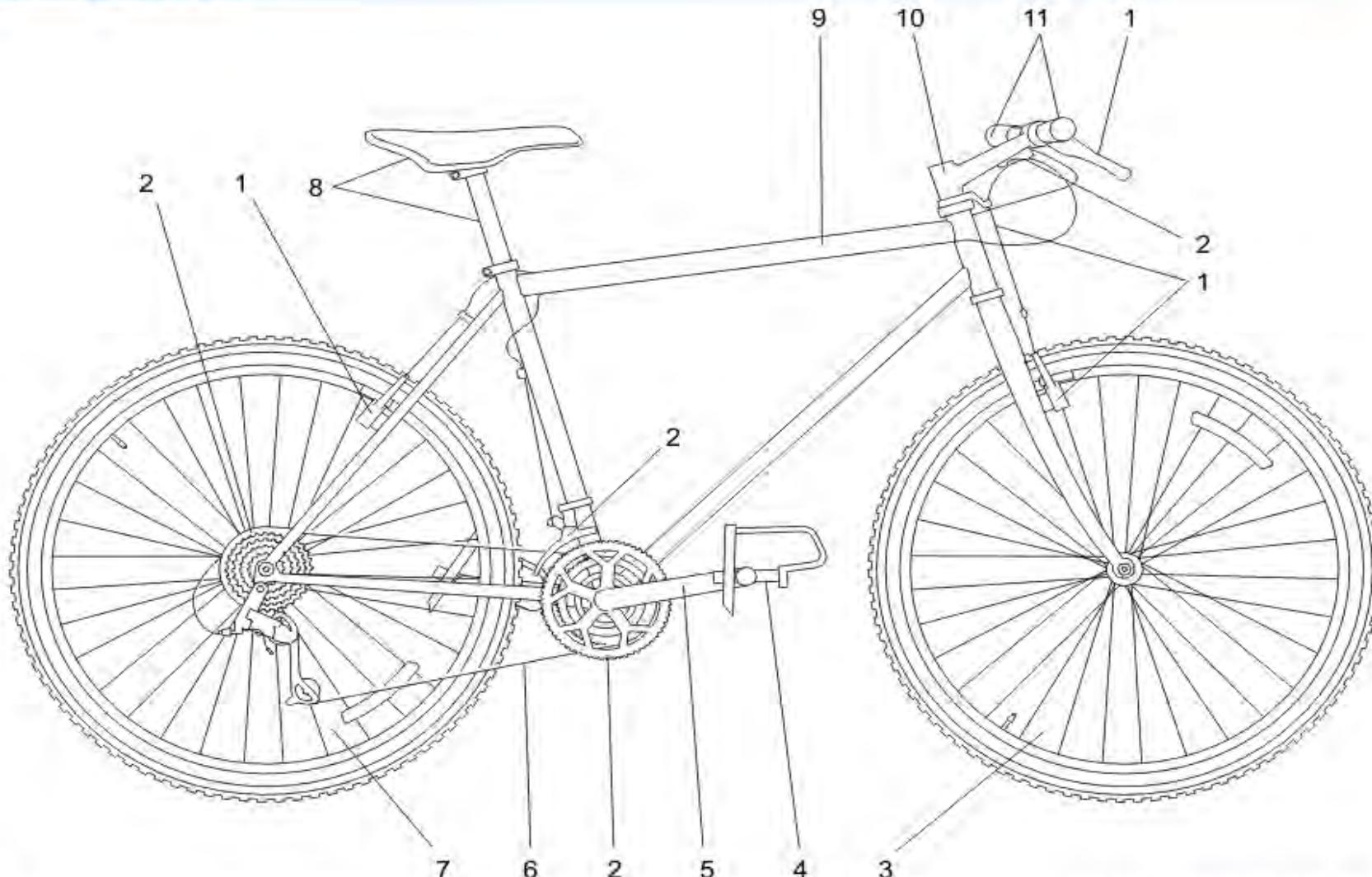
- Serves as authoritative source data stored in a Common Source Database as
 - Metadata defines type for S1000D player output
 - Content divided into XML-formatted Data Modules
- Promotes content reuse by serving as a vendor-neutral format for all technical data
- Enables management of technical training content and notification of engineering change proposals

SCORM – e-Learning Standards & Specs

- XML-based package of
 - Learning resource content to be delivered to the learner at run-time via a learning management system (LMS)
 - Metadata that define the context of packaged content
 - Processing instructions, to tell an LMS what to do with the content
- Enables interoperability of content across SCORM compliant LMSs
- Enables tracking of learner performance

S1000D Specification of Bike

2-D Technical Illustrations



Design Traceability Matrix

SweetSpot project: task maps, learning objectives, observable variables, X3D scenes, events, feedback								
S1000D	S1000D	S1000D	S1000D SCORM	S1000D SCORM	S1000D LMS X3D	S1000D LMS X3D	X3D / Java	S1000D ?LMS ?X3D
lcQuestion id="x" lcValue="y"		<description> <para>	Objective/ goal	Observable Variable(s)	X3D Scene: Objects and States	Feedback Condition	X3D eventSensor	FeedBack
Task 5.1		Inspect the tire for foreign objects and remove any if found	Inspect tire thoroughly for existing and potential new source(s) of puncture. Discover and dispose of found source(s) properly.	<ul style="list-style-type: none"> status insequence duration 	Objects: - bike tire - foreign objects - trash can - clock			
Task 5.1				<ul style="list-style-type: none"> duration 	Learner does not initiate interaction with the tire after <i>z</i> but <i>duration</i> < <i>maxDuration</i>	No tire touchSensor activation for <i>z</i> seconds	"Hint: Have you inspected for foreign objects that might have caused the puncture(s) or cause future punctures?"	



Life Cycle Management of Equipment-based Virtual Training and Assessment Content



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